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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/420,157	10/18/1999	ROBERT WILLIAM FILAS	22-176-48-44	2407

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EXAMINER

ROY, SIKHA

ART UNIT	PAPER NUMBER
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2879

DATE MAILED: 04/08/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

09/420,157

Applicant(s)

FILAS ET AL.

Examiner

Sikha Roy

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

## Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 12 February 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☐ Claim(s) \_\_\_\_\_ is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-18 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

## Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☒ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

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### DETAILED ACTION

The Amendment, filed on February 12, 2002, has been entered and is acknowledged by the Examiner.

Cancellation of claims 19-35 has been entered.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1- 14 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,250,984 to Jin et al. in view of U. S. Patent No. 5,973,444 to Xu et al.

Regarding claims 1, 10, 11 and 16 Jin et al. disclose (column 3 lines 13-15, 21-25) field emitter structures comprising exposed carbon nanowires (nanotubes) protruding from a conductive material, the extent of protrusion being at least twice the average diameter of the nanowires. The composite structure consisting of carbon nanotubes and conductive material (metal matrix) is utilized in order to have desired field concentration. The applicants' admitted prior art discloses (page 4 lines 23-25) nanowires with average diameters ranging from 0.5 nm to about 50 nm and aspect ratio about 10,000, have the lengths ranging from 5  $\mu$ m to 500  $\mu$ m which is within the claimed range of 0.1  $\mu$ m to about 10000  $\mu$ m. The metal/nanotube composite material offers

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relatively stable electrical contact. It is further noted that the multitude of emitters are formed on the substrate (Fig.9) in an X-Y matrix array.

Claim 1 differs from Jin et al. in that Jin et al. do not exemplify the magnetic material partially coating the nanowires.

Xu et al. in analogous art of carbon fiber -based field emission devices disclose (column 3 lines 42, column 5 lines 19-22) carbon fiber emitters grown on patterned substrate material. The substrate (12 FIG. 1) comprises of patterned growth surface (14) with Fe, Ni, Cr, Mn which are magnetic material. The nanowires (20) protruding from this composite material containing magnetic material are hence partly coated with the metals. This patterning provides the ability to fabricate arrays of individual field emitters.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the nanowires disclosed by Jin et al. by the ones partly coated with magnetic material as taught by Xu et al. for fabricating the arrays of emitters.

Referring to claim 2, Jin et al. disclose (column 3 lines 11,12) the device can be used as field emission displays.

Referring to claim 3, Jin et al. disclose (column 4 lines 50-53) the ends of the nanotubes being freshly broken provide even smaller radii of curvature for enhanced field concentration and electron emission.

Referring to claim 4 and 5, Xu et al. only teach that nanowires protruding from the composite material patterned with metal film are partially coated with the material.

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Xu et al. do not exemplify the volume percentage of magnetic material comprising the coating of the nanowires. It would have been obvious to one having ordinary skill in the art at the time the invention was made to specify the magnetic material comprising less than 0.95 or 0.75 volume % of the coated nanowires, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F 2d 272, 205 USPQ (CCPA 1980).

Referring to claims 6 and 7, Jin et al. disclose (column 10 lines 45,46) that the advantageously protrusion height of the nanowires is at least 10 times the nanotube diameter. It is noted (column 5 line 56) that single wall nanotubes exhibit typical diameter on the order of 1 to 5 nm and hence the protrusion heights may vary from 10 to 50 nm. Jin et al. teach that the protrusion height is preferably at least 100nm.

Referring to claim 8, Jin et al. disclose (column 7 lines 59-66) the incorporation of a relatively large volume fraction of the nanowires. The volume of the nanowires is typically at least  $10^{-7}$  volume fraction advantageously  $10^{-5}$  volume fraction of the matrix to a depth of at least 2  $\mu\text{m}$  from the surface from which nanowires protrude. It would have been obvious to one having ordinary skill in the art at the time the invention was made to specify the composite material comprising less than at least volume % of the nanowires, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch*, 617 F 2d 272, 205 USPQ (CCPA 1980).

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Referring to claim 9 Jin et al. disclose (column 5 lines 20, 21) the average variation in protrusion height is advantageously less than a factor of two which covers the limitation of the variation less than 40%.

Referring to claims 12-14, Jin et al. disclose a multi layer apertured grid structure with at least two and advantageously four grid conductors. The protruding nanowires from the surfaces of the substrate (Fig. 5D) provide arrayed emitter structures. An apertured grid structure is formed in front of the nanotube emitter structure separated by electrically insulating layer. As illustrated in FIG. 9 four layers of grid conductors 100A, 100B, 100C 100D separated by insulators define the aligned aperture and allow electron beams to be focused during traveling.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,250,984 to Jin et al. in view of U. S. Patent No. 5,973,444 to Xu et al. and further in view of applicants' admitted prior art (page 4 lines 2-4, 16-19).

Referring to claim 16, Jin et al. disclose (column 6, lines 9, 10, 34) the nanowires as carbon nanotubes and mixing of nanotubes with Ni, Fe metal powders. This would result in nanotubes having magnetic material present inside.

Claims 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over U. S. Patent No. 6,250,984 to Jin et al. in view of U. S. Patent No. 5,973,444 to Xu et al. and further in view of U. S. Patent No. 5,456,986 to Majetich et al.

Majetich et al. in relevant art of magnetic metal nanoparticles disclose (column 5 lines 9-13) the nanoparticles comprising of paramagnetic or ferromagnetic compound,

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the ferromagnetic compound selected from the group consisting of iron, cobalt, nickel. Majetich et al further teach (column 6 lines 16-18) that the nanoparticles packed with paramagnetic or ferromagnetic material can be segregated by magnetic moment per volume by varying magnetic field.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to specify the coating of the composite structure comprising of Fe, Ni, Co as ferromagnetic group as taught by Majetich et al. so that the nanowires grown on the composite material can be segregated by applying varying magnetic field.

Regarding claim 18, it would have been obvious to one of ordinary skill in the art at the time the invention was made to select the structure from the group comprising near-super-paramagnetic and super-paramagnetic, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice.

### ***Response to Arguments***

In response to applicants' argument that U. S. Patent 6,250,984 to Jin has the same assignee (Agree Systems Guardian Corporation) and hence is not available as 102(e)/103 prior art, examiner respectfully submits that this new change to 35 U.S.C. 103 (c) applies to all utility, design and plant patent applications filed on or after November 29, 1999, including continuing applications filed under 37 CFR 1.53(b),

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continued prosecution applications filed under 37 CFR 1.53(d) and reissues. The amendment to 35 U.S.C. 103 (c) does not affect any application filed before November 29, 1999. MPEP § 706.02(k). In the instant case, as the application was filed on October 18, 1999, U. S. Patent 6,250,984 to Jin can be used as 102(e)/103 prior art.

### ***Conclusion***

**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

### ***Contact Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Sikha Roy whose telephone number is (703) 308-2826. The examiner can normally be reached on Monday-Friday 8:00 a.m. – 4:30 p.m.



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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar D. Patel can be reached on (703) 305-4794. The fax phone number for the organization is (703) 308-7382.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.

*S.R.*

Sikha Roy  
Patent Examiner  
Art Unit 2879



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